

UNIVERSITY SENATE ROUTING LOG

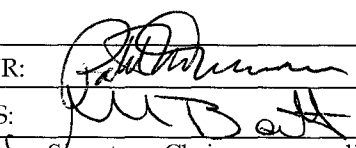
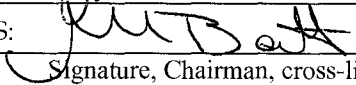
**Proposal Title:** Biosynthesis of Natural Products

**Name/email/phone for proposal contact:** David Watt, dwatt@uky.edu, 7.3945

**Instruction:** To facilitate the processing of this proposal please identify the groups or individuals reviewing the proposal, identify a contact person for each entry, provide the consequences of the review (specifically, approval, rejection, no decision and vote outcome, if any) and please attach a copy of any report or memorandum developed with comments on this proposal.

Reviewed by: (Chairs, Directors, Faculty Groups, Faculty Councils, Committees, etc)	Contact person Name (phone/email)	Consequences of Review:	Date of Proposal Review	Review Summary Attached? (yes or no)
Department of Molecular and Cellular Biochemistry Faculty	Dr Louis B Hersh 3.5549 lhersh@uky.edu	Approved	06-18-2007	Yes
COM	C DARRELL JENNINGS 7-52286 cdjenn@uky.edu	Approved	8-6-07	NO
COM	JENNIFER BRUECKNER 3-3780 jennifer.brueckner@uky.edu	Approved	8-21-07	NO
Faculty Council	JAY PARMAN 3-6582 japarmen@email.uky.edu	Approved	9-10-07	NO
COM				
Dean				

## APPLICATION FOR NEW COURSE

1. Submitted by College of Medicine Date 04-30-2007  
Department/Division offering course Department of Molecular and Cellular Biochemistry
2. Proposed designation and Bulletin description of this course
- a. Prefix and Number BCH 620 b. Title\* Biosynthesis of Natural Products  
*\*NOTE: If the title is longer than 24 characters (including spaces), write  
A sensible title (not exceeding 24 characters) for use on transcripts* Biosyn of Natural Prod
- c. Lecture/Discussion hours per week 3.0 d. Laboratory hours per week 0.0  
e. Studio hours per week 0.0 f. Credits 3.0
- g. Course description  
An overview of the biochemical pathways leading to compounds called natural products/  
secondary metabolites
- h. Prerequisites (if any)  
Two semesters of organic chemistry
- i. May be repeated to a maximum of N/A (if applicable)
4. To be cross-listed as PHR 620 PHR:   
PLS 620 PLS:   
Prefix and Number Signature, Chairman, cross-listing department
5. Effective Date Fall 2008 (semester and year)
6. Course to be offered  Fall  Spring  Summer
7. Will the course be offered each year?  Yes  No  
(Explain if not annually)  
N/A
8. Why is this course needed?  
To introduce graduate students to the source of natural products, many of which are used as pharmaceuticals
9. a. By whom will the course be taught? Watt (Medicine), Rohr and Crooks (Pharmacy), Chappell (Agriculture)  
b. Are facilities for teaching the course now available?  Yes  No  
If not, what plans have been made for providing them?  
N/A

## APPLICATION FOR NEW COURSE

10. What enrollment may be reasonably anticipated? 10 students/year

11. Will this course serve students in the Department primarily?  Yes  No

Will it be of service to a significant number of students outside the Department?  Yes  No  
If so, explain.

Students principally in pharmacy, agricultural sciences, and medical sciences will take this course.

Will the course serve as a University Studies Program course?  Yes  No

If yes, under what Area? N/A

12. Check the category most applicable to this course

traditional; offered in corresponding departments elsewhere;

relatively new, now being widely established

not yet to be found in many (or any) other universities

13. Is this course applicable to the requirements for at least one degree or certificate at the University of Kentucky?  Yes  No

14. Is this course part of a proposed new program:  Yes  No  
If yes, which?  
N/A

15. Will adding this course change the degree requirements in one or more programs?  Yes  No  
If yes, explain the change(s) below (NOTE – If "yes," a program change form must also be submitted.)

N/A

16. Attach a list of the major teaching objectives of the proposed course and outline and/or reference list to be used.

18. If the course is 400G or 500 level, include syllabi or course statement showing differentiation for undergraduate and graduate students in assignments, grading criteria, and grading scales.  Check here if 400G-500.

19. Within the Department, who should be contacted for further information about the proposed course?

Name David Watt

Phone Extension 7.3945

APPLICATION FOR NEW COURSE

Signatures of Approval:

06-18-2007

Date of Approval by Department Faculty

*Jennifer Brueckner* 8-21-07

Date of Approval by College Faculty

*Samuel Jones MD* 8-6-07

\*Date of Approval by Undergraduate Council

10/16/07

Curriculum Committee

\*Date of Approval by Graduate Council

\*Date of Approval by Health Care Colleges Council (HCCC)

\*Date of Approval by Senate Council

\*Date of Approval by University Senate

*Sam Hunt*  
Reported by Department Chair

Reported by Department Chair

*Ty Akers* 9-10-07  
Reported by College Dean

Reported by College Dean

Reported by Undergraduate Council Chair

*Walter M. Anderson*  
Reported by HCCC Chair

Reported by HCCC Chair

Reported by HCCC Chair

Reported by Senate Council Office

Reported by Senate Council Office

\*If applicable, as provided by the Rules of the University Senate

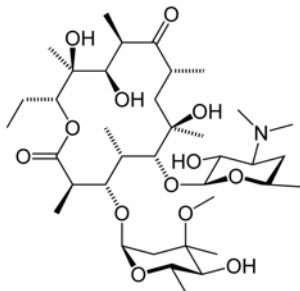
**Course Description**  
**Biosynthesis of Natural Products**  
**PHR620**

**(PHR760-011; BCH780-001; PLS697-002 for the Fall 2007 semester)**

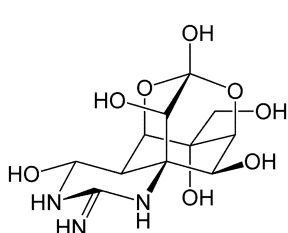
Last revised 10-17-07

Course objectives: Apart from the four general classes of biomolecules that appear in living systems, plants and microorganisms produce molecules unique to a particular species. These compounds, called “natural products”, possess a dazzling array of biological activities that are the basis for diverse industries ranging from fragrances to pharmaceuticals. For example,

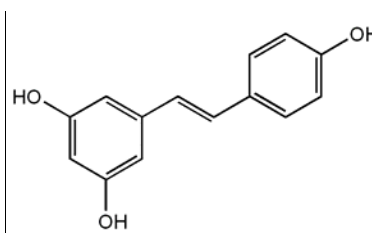
- The widely used antibiotic, erythromycin, is produced from a strain of the actinomycete bacteria, *Saccharopolyspora erythraea*.
- The skin and certain internal organs of many “puffer” fish in the Tetraodontidae family contain tetrodotoxin, an alkaloid that is highly toxic to humans. Nevertheless, these fish are considered a delicacy in both Japan and Korea.
- Resveratrol is found in the skin of red grapes and is a constituent of red wine and is implicated in the “French paradox”: coronary heart disease is relatively low in southern France despite high dietary intake of saturated fats.



erythromycin



tetrodotoxin



resveratrol

Students who take this course will be able to recognize the family to which a newly discovered natural product belongs and predict the likely source materials and pathways that gives rise to this natural product. Specifically, students will understand the shikimate, polyketide, mevalonate, and alkaloid pathways.

Course description: This course, entitled “Biosynthesis of Natural Products,” is designed for graduate students in chemistry, biochemistry and pharmacy. Introductory general chemistry, organic chemistry, and biochemistry courses are prerequisites for enrollment. Undergraduates may enroll in this course with the permission of the course director. This course will introduce students to the general families of secondary metabolites, typically called “natural products” and their biosynthesis as well as techniques used to study these compounds.

Course Director: A course director will be selected among Jurgen Rohr, Peter Crooks, Joseph Chappell and David Watt for a two-year term. The initial course director is David Watt.

David Watt  
Department of Molecular and Cellular Biochemistry  
Biomedical Biological Science Research Building, Room B181  
telephone: 257-3945  
email: [dwatt@uky.edu](mailto:d watt@uky.edu)

Class meeting: The course will meet on Monday and Wednesday at 10:00 AM to 11:30 AM in Room 206 of the College of Pharmacy Building. Students are urged to attend class. The lectures will highlight important concepts covered in the textbook and emphasize the material that will be covered on the examinations.

Office Hours: Tuesday, 3:00-5:00 PM, Biomedical Biological Science Research Building, Room B181. Access to this building can be somewhat problematic. You are advised to come across the bridge on Limestone that leads into this building. If you are unable to gain access through the double-doors that lead into the building, please call D. Watt at 257-3945 from the telephone outside the security door.

Textbook: P. M. Dewick, *Medicinal Natural Products: A Biosynthetic Approach*, 2<sup>nd</sup> edition, John Wiley and Sons

Blackboard: Copies of lecture notes will be posted on a BB site. Students should print copies of the slides and bring them to class. Students will need to get an account in order to gain access to this site. Only students registered in the course will be able to access these materials.

Examinations: Students will take three examinations. Two examinations (each of which is 90 minutes in length) will be administered during class periods designed in the syllabus and listed below. A comprehensive final examination (120 minutes in length) will be administered at the end of the course. For the Fall 2007 semester, these dates are as follows:

Examination 1, Monday, October 8 from 10:00-11:30AM

Examination 2, Monday, November 5 from 10:00-11:30AM

Final examination, Wednesday, December 12 from 8:00-10:00AM

"Make up" Examinations: Students who miss an hour examination for whatever reason will be tested on the material covered in that section of the course on the final examination. The final examination will serve as the "make up" examination. That is, if a student missed the first hour exam and received grades of 85, and 70 on the second, and final examinations, respectively, the

student's overall performance in the course would be determined by grades of 70 (final examination also counting as the first examination), 85 (second hour examination), and 70 (final examination).

Auditors: Students who wish to audit this course should see the instructor.

Grading: Grades will be determined on the basis of two hour examinations, and a comprehensive final examination.

Each of the hour examinations and the final examination will be worth 100 points. Students who fail to take an hour examination, for whatever reason, will have the final examination count more toward their final grade. That is, if a student missed the first hour exam and received grades of 85, and 70 on the second and final examinations, respectively, the student's overall performance in the course would be determined by grades of 70 (final examination also counting as the first examination), 85 (second hour examination), and 70 (final examination). Students are strongly encouraged to take all of the hour examinations. Students *must* take the final examination to receive a grade in this course.

Standards will be used to convert these overall numerical scores into letter grades: 90-100% is an A; 80-89% is a B; 70-79% is a C; and scores less than 70% are an E. These standards may be adjusted downward if this works to the students' benefit.

Regrading examinations: Students who believe that a mistake was made in the grading of an hour examination should re-submit the examination and a *signed note* that describes briefly which problem they want to have re-graded to the *course director*. Requests for re-grading of a particular hour examination must be submitted before the next hour examination. The examinations will be re-evaluated and returned with the subsequent hour examination. Students should be aware that a random number of examinations will be copied prior to returning them to the class.

Cheating: No form of cheating will be tolerated. Students are encouraged to read the Student Rights and Responsibilities with regard to cheating and plagiarism (<http://www.uky.edu/StudentAffairs/Code/part2-6.html>)

**Course Topics**  
**Biosynthesis of Natural Products**  
**Last revised 4-30-07**

**INITIAL OFFERING IN FALL 2007 WILL BE AS PHR760-011, BCH780-001  
and PLS697-002**

Introduction (3 lectures; Watt)

Primary and secondary metabolites: definitions

Historical context

Principal pathways

Biochemistry: an overview

Key players in "secondary metabolism": acetyl CoA, shikimate,  $\gamma,\gamma$ -dimethylallyl pyrophosphate, and amino acids

Brief overview of botanical classification

Conventions for writing mechanisms for organic chemical reactions

An overview of stereoisomerism: general understanding of the terms stereogenic centers, enantiomers, diastereomers, meso compounds, epimers and anomers

Fisher projections

R/S, D/L, d/l and (+)/(-) conventions

Conformational analysis: Haworth projections, chairs, envelopes

Carbohydrates (4 lectures; Rohr)

Glucose: structure and biosynthesis

Brief review of photosynthesis

Brief review of glycolysis/gluconeogenesis, the citric acid cycle and the glucose shunt ( $C_5$  carbohydrates)

Deoxysugar and aminosugar biosynthesis

Other monosaccharides

Polysaccharides

Shikimate pathways (6 lectures; Watt)

Biosynthesis of shikimic acid and aromatic amino acids

Redox reactions in biosynthesis: hydroxylation, peroxidation and epoxidation as recurring themes

Phe-derived natural products

Cinnamic and benzoic acids

Coumarins

Quinones

Lignins

Polyketide pathways (6 lectures; Rohr)

Fatty acid anabolism/catabolism

Even and odd-numbered chains

Unsaturated fatty acids

Polyketides: Type 1 (erythromycin), type 2 (anthraquinones and tetracyclins), type 3 (chalcones, stilbenes)

Oxidative coupling of phenols: biphenyls and diphenyl ethers

Further modifications of carbon skeletons

Mevalonate pathways (10 lectures; Chappell)

Mevalonate biosynthesis

Biosynthesis of acyclic isoprenoids

Monoterpenes

Sesquiterpenes

Diterpenes

Steroids

Higher-order terpenes

Alkaloids and amino-acid derived natural products (10 lectures; Crooks)

Biosynthesis of amino acids (an overview)

Natural products derived from Ser and Cys

Natural products derived from Val, Leu and Ile

Natural products derived from aromatic amino acids

β-lactam biosynthesis

Alkaloids derived from ornithine and lysine

Alkaloids derived from aromatic amino acids and anthranilic acid

Pyrimidines, purines and pteridines

Pyrroles and porphyrins

Corrins

**Syllabus for Fall 2007**  
**PHR760-011, BCH780-001 and PLS697-002**

Lecture	Day	Date	Reading	Topic
1	W	22-Aug	Ch 1 and 2	Introduction
2	M	27-Aug	Ch 1 and 2	Introduction
3	W	29-Aug	Ch 8	Carbohydrates
4	M	29-Aug	Ch 8	Carbohydrates
	M	3-Sep		<b>LABOR DAY HOLIDAY</b>
5	W	5-Sep	Ch 8	Carbohydrates
6	M	10-Sep	Ch 4	Shikimate Pathway
7	W	12-Sep	Ch 4	Shikimate Pathway
8	M	17-Sep	Ch 4	Shikimate Pathway
9	W	19-Sep	Ch 4	Shikimate Pathway
10	M	24-Sep	Ch 3	Polyketides
11	W	26-Sep	Ch 3	Polyketides
12	M	1-Oct	Ch 3	Polyketides
13	W	3-Oct	Ch 3	Polyketides
	M	8-Oct		<b>EXAMINATION 1</b>
14	W	10-Oct	Ch 5	Mevalonate Pathways
15	M	15-Oct	Ch 5	Mevalonate Pathways
16	W	17-Oct	Ch 5	Mevalonate Pathways
17	M	22-Oct	Ch 5	Mevalonate Pathways
18	W	24-Oct	Ch 5	Mevalonate Pathways
19	M	29-Oct	Ch 5	Mevalonate Pathways
20	W	31-Oct	Ch 5	Mevalonate Pathways
	M	5-Nov		<b>EXAMINATION 2</b>
21	W	7-Nov	Ch 6 and 7	Alkaloids
22	M	12-Nov	Ch 6 and 7	Alkaloids
23	W	14-Nov	Ch 6 and 7	Alkaloids
24	M	19-Nov	Ch 6 and 7	Alkaloids
25	W	21-Nov	Ch 6 and 7	Alkaloids
26	M	26-Nov	Ch 6 and 7	Alkaloids
27	W	28-Nov	Ch 6 and 7	Alkaloids
28	M	3-Dec	Ch 6 and 7	Alkaloids
29	W	5-Dec	All	Summary

Molecular and Cellular Biochemistry  
Faculty Meeting Minutes Excerpt  
June 18, 2007

2. New Course Offering – David Watt

Dr. Watt announced his desire to launch a new course, Biosynthesis of Natural Products, (BCH 620, PHR 620, PLS 620), to be developed in conjunction with Plant Sciences and Pharmaceutical Sciences. The faculty unanimously approved the proposal. For the initial offering of this course in the Fall 2007 semester, it will be administered as PHR760-011, BCH780-001, and PLS697-002.